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TI **Iron**-chromium-**aluminum** alloy having improved high-temperature strength and oxidation resistance after welding
IN Okuyama, Kaoru; Ishii, Kazuhide
PA Kawasaki Steel Co, Japan
SO Jpn. Kokai Tokkyo Koho, 5 pp.
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AB The **Fe** alloy contains C .ltoreq.0.05, Si .ltoreq.1.5, Mn .ltoreq.1.0, **Cr** 11.0-26, **Al** 1.0-8.0, N .ltoreq.0.03, **Ti** 0.01-2.0, **Zr** 0.01-2.0 with (**Ti** + **Zr**) >1.5 but .ltoreq.3.0, La 0.05-0.2, and Ce .ltoreq.0.03%. The **Fe** alloy may addnl. contain 0.01-1.5% Nb with (**Ti** + **Zr** + Nb) >1.5 but .ltoreq.3.0% and alternatively contain 0.05-0.2% lanthanide series other than Ce. The **Fe** alloy is suitable for manuf. of substrates of catalyst of automotive exhaust system and catalyst converters.

PATENT ABSTRACTS OF JAPAN

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(54) FE-CR-AL ALLOY EXCELLENT IN HIGH TEMPERATURE STRENGTH AFTER BRAZING AND OXIDATION RESISTANCE

(57)Abstract:

PURPOSE: To produce an alloy excellent in high temp. strength and oxidation resistance by constituting Fe-Cr-Al alloy of specified wt.% of C, Si, Mn, Cr, Al, N, Ti, Zr, La, Ce and Fe.

CONSTITUTION: The componental compsn. of this Fe-Cr-Al alloy is constituted of the one contg., by weight, ≤0.05% C, ≤1.5% Si, ≤1% Mn, 11 to 26% Cr, 1 to 8% Al, ≤0.03% N, 0.01 to 2% Ti and 0.01 to 2% Zr, in which the total content of Ti+Zr satisfies 1.5%<Ti+Zr≤3%, contg. 0.05 to 0.2% La and ≤0.03% Ce, and the balance Fe with inevitable impurities. Furthermore, the content of lanthanoids other than Ce is regulated to 0.001 to 0.05%, and the total content of lanthanoids is regulated to 0.05 to 0.2%. The total content of Ti+Zr+Nb satisfies 1.5%<Ti+Zr+Nb≤3%. In this way, the alloy suitable as a heat resistant material including the material for automotive catalitic converter can be provided.

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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] By weight %, C:0.05% or less, Si: Less than [less than / 1.5% / Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0% Less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr fills 1.5%<Ti+Zr<=3.0% Zr:0.01 to 2.0%. La: The Fe-Cr-aluminum system alloy excellent in the high temperature strength after soldering characterized by the bird clapper from Remainder Fe and an unescapable impurity 0.05-0.2% including less than [Ce:0.03%], and oxidation resistance.
[Claim 2] By weight %, C:0.05% or less, Si: Less than [less than / 1.5% / Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0% Less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr 1.5%<Ti+Zr<=3.0% lanthanoids:Ce Zr:0.01 to 2.0% 0.03% or less, The Fe-Cr-aluminum system alloy excellent in the high temperature strength after soldering to which it is within the limits of 0.001 - 0.05% of other lanthanoidses, and the sum total of a lanthanoids considers a b clapper as the feature from Remainder Fe and an unescapable impurity including 0.05 - 0.2%, and oxidation resistan
[Claim 3] By weight %, C:0.05% or less, Si: Less than [less than / 1.5% / Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0% Less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr+Nb Zr:0.01-2.0%Nb:0.01-1.5% The Fe-Cr-aluminum system alloy excellent in the high temperature strength after soldering which fills 1.5%<Ti+Zr+Nb<=3.0% and is characterized by the bird clapper from Remainder Fe and an unescapable impurity La:0.05-0.2% including les than [Ce:0.03%], and oxidation resistance.
[Claim 4] By weight %, C:0.05% or less, less than [less than / Si:1.5% / Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0 less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr+Nb Zr:0.01-2.0%Nb:0.01-1.5% Ce 1.5% <Ti+Zr+Nb<=3.0% lanthanoids : 0.03% or less, The Fe-Cr-aluminum system alloy excellent in the high temperature strength after soldering to which it is within the limits of 0.001 - 0.05% of other lanthanoidses, and the sum total of a lanthanoids considers a bird clapper as the feature from Remainder Fe and an unescapable impurity including 0.05 - 0.2%, and oxidation resistance.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the Fe-Cr-aluminum system alloy board excellent in the high temperature strength after soldering, and oxidation resistance, and its foil. This alloy is the material of the parts assembled by soldering, and is suitable for the catalyst support for automobile exhaust purification and catalytic converter which receive an intense vibration and thermal stimulation under high-temperature-oxidation nature atmosphere.
[0002]
[Description of the Prior Art] In recent years, the support which assembled the Fe-Cr-aluminum system alloy foil in shape of a honeycomb by soldering as support of automobile exhaust purification catalyst equipment is being adopte However, to raise the exhaust gas purification efficiency at the time of a cold start especially is needed by strengthen of automobile exhaust regulation. Therefore, automobile exhaust purification catalyst equipment installs a converter the position near combustion environment, and is made to reach catalytic activity-ized temperature by hot exhaust ga earlier than the early stages of engine starting, and the thing which makes catalytic reaction cause is being developed Moreover, from the engine vibration by the high increase in power of an engine and miniaturization and the exhaust shock increasing, with the conventional Fe-aluminum-Cr alloy, the high temperature strength runs short and it canno put [honeycomb breakage can arise and] in practical use.
[0003] The example which has improved own intensity of a material by Nb addition is indicated by JP,4-120247,A a JP,58-177437,A. However, grain-boundary intensity will fall remarkably and a honeycomb will damage the foil material assembled by soldering.
[0004]
[Problem(s) to be Solved by the Invention] As mentioned above, when using the conventional Fe-Cr-aluminum alloy by soldering, since intensity is insufficient, practical use is not borne. this invention was excellent in the intensity in elevated temperature which canceled the fault of the conventional technology mentioned above, and oxidation resistance -- it aims at the thing suitable as an Fe-Cr-aluminum alloy, especially a charge of catalyst-support material for which board thickness offers an Fe-Cr-aluminum alloy board 0.5mm [or less] and a foil 0.1mm or less Moreove this material is desirable also as the device of a combustion gas exhaust air system assembled by soldering, and equipment.
[0005]
[Means for Solving the Problem] According to the first mode of this invention, by weight % C:0.05% or less, Si: Les than [less than / 1.5% / Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0% Less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr fills 1.5%<Ti+Zr<=3.0% Zr:0.01 to 2.0%. La: The Fe-Cr-aluminum system alloy excellent in the h temperature strength after soldering characterized by the bird clapper from Remainder Fe and an unescapable impuri and oxidation resistance is offered 0.05-0.2% including less than [Ce:0.03%].
[0006] According to the second mode of this invention, by weight % C:0.05% or less, Si: Less than [less than / 1.5% Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0% Less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr 1.5% <Ti+Zr<=3.0% lanthanoids:Ce Zr:0.01 to 2.0% 0.03% or less, The Fe-Cr-aluminum system alloy excellent in the hig temperature strength after soldering to which it is within the limits of 0.001 - 0.05% of other lanthanoidses, and the s total of a lanthanoids considers a bird clapper as the feature from Remainder Fe and an unescapable impurity includi 0.05 - 0.2%, and oxidation resistance is offered.
[0007] According to the third mode of this invention, by weight % C:0.05% or less, Si: Less than [less than / 1.5% /

Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0% Less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr+Nb Zr:0.01-2.0%Nb:0.01-1.5% 1.5%<Ti+Zr+Nb<=3.0% is filled and the Fe-Cr-aluminum system alloy excellent in the high temperature strength after soldering characterized by the bird clapper from Remainder Fe and an unescapable impurity and oxidation resistance is offered La:0.05-0.2% including less than [Ce:0.03%].
[0008] According to the fourth mode of this invention, by weight % C:0.05% or less, less than [less than / Si:1.5% / Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0%, less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr+Nb Zr:0.01-2.0%Nb:0.01-1.5% Ce 1.5%<Ti+Zr+Nb<=3.0% lanthanoids : 0.03% or less, The Fe-Cr-aluminum system alloy excellent in the high temperature strength after soldering to which it is within the limits of 0.001 - 0.05% of oth lanthanoidses, and the sum total of a lanthanoids considers a bird clapper as the feature from Remainder Fe and an unescapable impurity including 0.05 - 0.2%, and oxidation resistance is offered.
[0009]
[Function] this invention is explained further below at a detail. The Fe-Cr-aluminum alloy of this invention has four modes, and, fundamentally, contains C, Si, Mn, Cr, aluminum, and N. The element of the combination of the two following groups is contained in addition to it. the following (1-1) and (1-2) -- and (2-1) (2-2) can improve the high temperature strength after soldering, and oxidation resistance with combination Especially the use is suitable for hea resisting material including charges of catalytic-converter material, such as an automobile, as an alloy board or a foil
(1) Ti, Zr, and Nb (1-1) -- when it contains Ti and Zr, Ti+Zr may be 1.5 - 3%
(1-2) Moreover, when it contains Nb in addition to these, Ti+Zr+Nb may be 1.5 - 3%.
(2) When it contains inner La of a lanthanoids (2-1) lanthanoids, you may be 0.05 - 0.2%.
(2-2) When it contains the lanthanoids except Ce, 0.001 - 0.05% and the total quantity of those may be 0.05 - 0.2%.
(2-1) In any case, and (2-2) makes Ce 0.03% or less.
[0010] Next, the reason for limitation of each component of this invention alloy is explained. In addition, 0% is included about a thing without a minimum.
In order that aluminum:aluminum may secure oxidation resistance and creep strength in this invention, when it is an indispensable element and an Fe-Cr-aluminum alloy is held to an elevated temperature, priority oxidization of the aluminum is carried out from Fe-Cr, and it is high aluminum 2O3 of protection nature to an alloy front face. A coat i generated and oxidation resistance is improved. aluminum 2O3 which was excellent in oxidation resistance and cree strength in aluminum content being less than 1.0% In order that a coat may not generate, the minimum is limited to 1.0% or more. Although it is desirable to raise aluminum content from the point of oxidation resistance and a creep property, since hot rolling is difficult if aluminum exceeds 8% by one side, the upper limit is limited to 8% or less.
[0011] Cr:Cr not only has the role which raises the oxidation resistance of aluminum, but is an element the Cr itself raises oxidation resistance. At less than 11%, oxidation resistance was not securable, and since toughness fell and co rolling became difficult when 26% was exceeded, it could be 26% or less 11% or more here.
[0012] Since it will reduce toughness and will reduce manufacturability if it is contained so much, although Si:Si is a element which raises oxidation resistance like aluminum, it limits the upper limit to 1.5% or less.
[0013] Although it may remain in steel when Mn:Mn is added as reserve material of aluminum deoxidation, since M degrades oxidation resistance and corrosion resistance, the fewer one is good. In consideration of industrial and economical ingot technology, it limited to 1.0% or less.
[0014] aluminum 2O3 which generates La:La at an elevated temperature in an Fe-Cr-aluminum alloy, and Cr 2O3 et - the adhesion of an oxide film is improved and it has an effect very remarkable in oxidation resistance and the improvement in a peeling resistance of the scale Since ablation prevention of the scale also adds the intensity of an oxide film to the creep strength not only in oxidation-resistant improvement but a foil, it is a very important element. less than 0.05%, since this effect cannot secure an anti-oxidation property and a creep property but the hot rolling of becomes impossible at 0.2% or more, it is limited to 0.2% or less 0.05% or more.
[0015] when it has the effect which improves oxidation resistance through the lanthanoids except lanthanoids:Ce except Ce improving the adhesion of the oxide film generated at an elevated temperature like La to an Fe-Cr-aluminu system alloy and generates La from a source ore, it can La-depend and the lanthanoids excluding Ce from the directi at the time of [pure /, such as Nd etc.,] containing being easy can be made to contain in 0.001 - 0.05% of range Sinc hot rolling will become impossible if it adds so much to it, the sum total of a lanthanoids may be 0.2% or less.
[0016] Ce: Addition of Ce is not avoided although it is economical if it adds by the misch metal in case rare earth is added. Although it is more desirable not to add since Ce degrades hot-working nature and oxidation resistance, at 0.03% or less, there is no manufacture top problem on a property. Therefore, the upper limit of addition is limited to

0.03% or less.
[0017] There are Zr:ZrN and an effect which generates ZrC and raises a high temperature strength. Moreover, Zr carries out surface concentration and is ZrO2. An oxide is generated. Zr suppresses the oxidative consumption of aluminum, when it contains by La and composite, and it is aluminum 2O3. A coat and Cr 2O3 Time to form a coat is extended and the oxidation resistance of an alloy is raised. This effect becomes remarkable at 0.01% or more. From t strong point, although adding as mostly as possible was desirable as for Zr, since oxidation resistance fell when the content exceeded 2.0%, the content was made into 2.0% or less 0.01% or more.
[0018] Ti:Ti has the effect which generates TiNTiC like Zr and raises a high temperature strength. Since this effect i ineffective if it does not add 0.01% or more, it makes the minimum 0.01% or more. Moreover, since oxidation resistance will fall if it adds superfluously, the upper limit is limited to 2.0%. When Ti and Zr live together, Ti+Zr m be 1.5 - 3.0%. At less than 1.5%, when it is inferior to the creep property after brazing and soldering and exceeds 3% is for oxidation resistance to fall.
[0019] Nb:Nb also has the effect which generates NbCNbN and raises a high temperature strength like Zr and Ti. Sin this effect is ineffective if it does not add 0.01% or more, it makes the minimum 0.01%. Moreover, since oxidation resistance will fall if it adds superfluously, the upper limit is limited to 2.0%. When it coexists with Ti and Zr, Ti+Zr+Nb may be 1.5 - 3%. At less than 1.5%, when it is inferior to the creep property after brazing and soldering an exceeds 3%, it is for oxidation resistance to fall.
[0020] C: Since C will reduce toughness to a high temperature strength and an oxidation-resistant pan if it becomes superfluous, make it more desirable to decrease as much as possible. Therefore, it limits to 0.05% or less.
[0021] N: Since Zr, Ti, Nb, etc. which are the generation element of detailed carbide are fixed as an N ghost, the carbide of big and rough Cr and Fe deposits and N falls the intensity in an elevated temperature, it is desirable to ma it decrease as much as possible. Moreover, if N becomes superfluous, toughness will be reduced and cold rolling nat and processability will be reduced. It reacts with aluminum, and when big and rough AlN (-10micrometer) was deposited and it rolls out in an about 50-micrometer foil, it also becomes the cause of a hole aperture. Therefore, it limits to 0.03% or less.
[0022]
[Example] this invention is concretely explained based on an example below.
(Example) The chemical composition of the example of this invention and the example of comparison is shown in Table 1. These materials were ingoted by vacuum melting, were hot-rolled to 3mm of board thickness after heating a 1250 degrees C, repeated annealing and cold rolling, and used them as the 50-micrometer foil. After performing vacuum soldering for this rolling foil at 1200 degrees C using nickel brazing filler metal, oxidation-resistant investigation was conducted. The result is similarly shown in Table 1. Oxidization increase in quantity is 1.5 mg/cm by oxidization (1200 degrees C and 150h). O showed the thing of the following and x showed the thing beyond this. Moreover, evaluation of a high temperature strength uses a 50-micrometer cold-rolled foil, and is 2 the inside of 800 degrees C and the atmosphere, and 3 kgf/mm initial stress. The creep test which carried out the load performed. Fracture time showed the thing 8h or more by O mark, and showed the thing below this by x. this invention steel 1-7 excellent in oxidation resistance and creep strength. On the other hand, oxidation resistance is inferior to a creep property in it, although the comparison steel 8-11 is excellent, and although the comparison steel 12 is excellent in a creep property, it is inferior to an anti-oxidation property in it. moreover, the comparison steel 13-15 -- oxidation resistance and a creep property -- it is inferior to any property
[0023]
[Table 1]

表　1

		化学組成（重量%）															特性	
		C	Si	Mn	P	S	Al	Cr	Zr	Ti	La	La+Nd	Ce	Nb	N	α	耐酸化性	耐高温強度
発明鋼	1	0.0045	0.21	0.11	0.02	0.003	6.5	19.2	1.5	0.6	0.10	—	—	—	0.0043	2.1	○	○
	2	0.013	0.12	0.12	0.02	0.003	5.3	20.3	1.0	1.1	0.08	—	—	—	0.0063	2.1	○	○
	3	0.0061	1.4	0.31	0.03	0.002	1.5	25.7	1.6	0.02	—	0.09	0.01	—	0.0052	1.62	○	○
	4	0.0068	0.23	0.45	0.02	0.004	3.1	18.2	0.03	1.8	—	0.11	—	—	0.0043	1.83	○	○
	5	0.0054	0.35	0.51	0.04	0.003	4.5	24.5	0.6	0.9	—	0.15	—	1.0	0.0039	2.5	○	○
	6	0.011	0.51	0.22	0.03	0.002	7.5	11.2	0.08	1.50	0.12	—	0.02	—	0.0058	1.58	○	○
	7	0.0084	0.41	0.23	0.03	0.003	5.1	19.9	0.8	0.4	0.10	—	—	0.4	0.0049	1.6	○	○
比較鋼	8	0.019	0.52	0.21	0.01	0.002	6.3	22.0	1.0	—	0.07	—	—	—	0.0051	1.0	○	×
	9	0.0086	0.33	0.65	0.02	0.002	5.3	19.8	1.2	—	—	0.05	—	0.8	0.0055	2.0	○	×
	10	0.0075	0.15	0.33	0.02	0.001	1.4	21.2	0.4	0.8	—	0.06	—	—	0.0065	1.2	○	×
	11	0.0084	0.12	0.25	0.03	0.001	4.9	18.9	0.35	0.4	0.08	—	—	0.5	0.0043	1.25	○	×
	12	0.009	0.41	0.81	0.03	0.003	4.2	16.3	1.0	1.1	0.05	—	0.05	—	0.007	2.1	×	○
	13	0.013	0.48	0.14	0.03	0.003	6.0	18.5	—	—	0.06	—	—	2.2	0.0042	2.2	×	×
	14	0.024	0.65	0.45	0.03	0.003	5.2	20.1	—	1.3	—	0.07	—	—	0.0053	1.3	×	×
	15	0.018	0.22	0.71	0.03	0.004	3.3	19.9	—	1.8	—	0.05	—	1.0	0.0061	2.8	×	×

α＝Ｔｉ＋Ｚｒまたは Ｔｉ＋Ｚｒ＋Ｎｂ

単位：重量%

[0024]
[Effect of the Invention] this invention can provide an Fe-Cr-aluminum system alloy with the alloy excellent in a hig temperature strength and oxidation resistance Ti, Zr, or by carrying out compound addition of the Nb further, and containing La or a lanthanoids. The alloy board of this invention and its foil are alloys suitable as heat-resisting material including charges of catalytic-converter material, such as an automobile, and show the performance which w excellent especially as a foil of 0.1mm or less of board thickness.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] this invention relates to the Fe-Cr-aluminum system alloy board excellent in the high temperature strength after soldering, and oxidation resistance, and its foil. This alloy is the material of the parts assembled by soldering, and is suitable for the catalyst support for automobile exhaust purification and catalytic converter which receive an intense vibration and a heat stimulus under high-temperature-oxidation nature atmospher

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PRIOR ART

[Description of the Prior Art] In recent years, the support which assembled the Fe-Cr-aluminum system alloy foil in shape of a honeycomb by soldering as support of automobile exhaust purification catalyst equipment is being adopte However, to raise the exhaust gas purification efficiency at the time of a cold start especially is needed by strengthen of automobile exhaust regulation. Therefore, automobile exhaust purification catalyst equipment installs a converter the position near combustion environment, and is made to reach catalytic activity-ized temperature by hot exhaust ga earlier than the early stages of engine starting, and the thing which makes catalytic reaction cause is being developed Moreover, from the engine vibration by the high increase in power of an engine and miniaturization and the exhaust shock increasing, with the conventional Fe-aluminum-Cr alloy, the high temperature strength runs short and it canno put [honeycomb breakage can arise and] in practical use.
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EFFECT OF THE INVENTION

[Effect of the Invention] this invention can provide an Fe-Cr-aluminum system alloy with the alloy excellent in a hig temperature strength and oxidation resistance Ti, Zr, or by carrying out compound addition of the Nb further, and containing La or a lanthanoids. The alloy board of this invention and its foil are alloys suitable as heat-resisting material including charges of catalytic-converter material, such as an automobile, and show the performance which w excellent especially as a foil of 0.1mm or less of board thickness.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] As mentioned above, when using the conventional Fe-Cr-aluminum alloy by soldering, since intensity is insufficient, practical use is not borne. this invention was excellent in the intensity in elevated temperature which canceled the fault of the conventional technology mentioned above, and oxidation resistance -- it aims at the thing suitable as an Fe-Cr-aluminum alloy, especially a charge of catalyst-support material for which board thickness offers an Fe-Cr-aluminum alloy board 0.5mm [or less] and a foil 0.1mm or less Moreove this material is desirable also as the device of a combustion gas exhaust air system assembled by soldering, and equipment.

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MEANS

[Means for Solving the Problem] According to the first mode of this invention, by weight % C:0.05% or less, Si: Les than [less than / 1.5% / Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0% Less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr fills 1.5%<Ti+Zr<=3.0% Zr:0.01 to 2.0%. La: The Fe-Cr-aluminum system alloy excellent in the h temperature strength after soldering characterized by the bird clapper from Remainder Fe and an unescapable impuri and oxidation resistance is offered 0.05-0.2% including less than [Ce:0.03%].
[0006] According to the second mode of this invention, by weight % C:0.05% or less, Si: Less than [less than / 1.5% Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0% Less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr 1.5% <Ti+Zr<=3.0% lanthanoids:Ce Zr:0.01 to 2.0% 0.03% or less, The Fe-Cr-aluminum system alloy excellent in the hig temperature strength after soldering to which it is within the limits of 0.001 - 0.05% of other lanthanoidses, and the s total of a lanthanoids considers a bird clapper as the feature from Remainder Fe and an unescapable impurity includi 0.05 - 0.2%, and oxidation resistance is offered.
[0007] According to the third mode of this invention, by weight % C:0.05% or less, Si: Less than [less than / 1.5% / Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0% Less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr+Nb Zr:0.01-2.0%Nb:0.01-1.5% 1.5%<Ti+Zr+Nb<=3.0% is filled and the Fe-Cr-aluminum system alloy excellent in the high temperature strength after soldering characterized by the bird clapper from Remainder Fe and an unescapable impurity and oxidation resistance is offered La:0.05-0.2% including less than [Ce:0.03%].
[0008] According to the fourth mode of this invention, by weight % C:0.05% or less, less than [less than / Si:1.5% / Mn:1.0%], Cr: 11.0-26%aluminum:1.0-8.0%, less than [N:0.03%] Ti:0.01-2.0%, The total amount of Ti+Zr+Nb Zr:0.01-2.0%Nb:0.01-1.5% Ce 1.5%<Ti+Zr+Nb<=3.0% lanthanoids : 0.03% or less, The Fe-Cr-aluminum system alloy excellent in the high temperature strength after soldering to which it is within the limits of 0.001 - 0.05% of oth lanthanoidses, and the sum total of a lanthanoids considers a bird clapper as the feature from Remainder Fe and an unescapable impurity including 0.05 - 0.2%, and oxidation resistance is offered.

[Translation done.]

OPERATION

[Function] this invention is explained further below at a detail. The Fe-Cr-aluminum alloy of this invention has four modes, and, fundamentally, contains C, Si, Mn, Cr, aluminum, and N. The element of the combination of the two following groups is contained in addition to it. the following (1-1) and (1-2) -- and (2-1) (2-2) can improve the high temperature strength after soldering, and oxidation resistance with combination Especially the use is suitable for hea resisting material including charges of catalytic-converter material, such as an automobile, as an alloy board or a foil
(1) Ti, Zr, and Nb (1-1) -- when it contains Ti and Zr, Ti+Zr may be 1.5 - 3%
(1-2) Moreover, when it contains Nb in addition to these, Ti+Zr+Nb may be 1.5 - 3%.
(2) When it contains inner La of a lanthanoids (2-1) lanthanoids, you may be 0.05 - 0.2%.
(2-2) When it contains the lanthanoids except Ce, 0.001 - 0.05% and the total quantity of those may be 0.05 - 0.2%.
(2-1) In any case, and (2-2) makes Ce 0.03% or less.
[0010] Next, the reason for limitation of each component of this invention alloy is explained. In addition, 0% is included about a thing without a minimum.
In order that aluminum:aluminum may secure oxidation resistance and creep strength in this invention, when it is an indispensable element and an Fe-Cr-aluminum alloy is held to an elevated temperature, priority oxidization of the aluminum is carried out from Fe-Cr, and it is high aluminum 2O3 of protection nature to an alloy front face. A coat i generated and oxidation resistance is improved. aluminum 2O3 which was excellent in oxidation resistance and cree strength in aluminum content being less than 1.0% In order that a coat may not generate, the minimum is limited to 1.0% or more. Although it is desirable to raise aluminum content from the point of oxidation resistance and a creep property, since hot rolling is difficult if aluminum exceeds 8% by one side, the upper limit is limited to 8% or less.
[0011] Cr:Cr not only has the role which raises the oxidation resistance of aluminum, but is an element the Cr itself raises oxidation resistance. At less than 11%, oxidation resistance was not securable, and since toughness fell and co rolling became difficult when 26% was exceeded, it could be 26% or less 11% or more here.
[0012] Since it will reduce toughness and will reduce manufacturability if it is contained so much, although Si:Si is a element which raises oxidation resistance like aluminum, it limits the upper limit to 1.5% or less.
[0013] Although it may remain in steel when Mn:Mn is added as reserve material of aluminum deoxidation, since M degrades oxidation resistance and corrosion resistance, the fewer one is good. In consideration of industrial and economical ingot technology, it limited to 1.0% or less.
[0014] aluminum 2O3 which generates La:La at an elevated temperature in an Fe-Cr-aluminum alloy, and Cr 2O3 et - the adhesion of an oxide film is improved and it has an effect very remarkable in oxidation resistance and the improvement in a peeling resistance of the scale Since exfoliation prevention of the scale also adds the intensity of a oxide film to the creep strength not only in oxidation-resistant improvement but a foil, it is a very important element. less than 0.05%, since this effect cannot secure an anti-oxidation property and a creep property but the hot rolling of becomes impossible at 0.2% or more, it is limited to 0.2% or less 0.05% or more.
[0015] when it has the effect which improves oxidation resistance through the lanthanoids except lanthanoids:Ce except Ce improving the adhesion of the oxide film generated at an elevated temperature like La to an Fe-Cr-aluminu system alloy and generates La from a source ore, it can La-depend and the lanthanoids excluding Ce from the directi at the time of [pure /, such as Nd etc.,] containing being easy can be made to contain in 0.001 - 0.05% of range Sinc hot rolling will become impossible if it adds so much to it, the sum total of a lanthanoids may be 0.2% or less.
[0016] Ce: Addition of Ce is not avoided although it is economical if it adds by the misch metal in case rare earth is added. Although it is more desirable not to add since Ce degrades hot-working nature and oxidation resistance, at 0.03% or less, there is no manufacture top problem on a property. Therefore, the upper limit of addition is limited to

0.03% or less.
[0017] There are Zr:ZrN and an effect which generates ZrC and raises a high temperature strength. Moreover, Zr carries out surface concentration and is ZrO2. An oxide is generated. Zr suppresses the oxidative consumption of aluminum, when it contains by La and composite, and it is aluminum 2O3. A coat and Cr 2O3 Time to form a coat is extended and the oxidation resistance of an alloy is raised. This effect becomes remarkable at 0.01% or more. From t strong point, although adding as mostly as possible was desirable as for Zr, since oxidation resistance fell when the content exceeded 2.0%, the content was made into 2.0% or less 0.01% or more.
[0018] Ti:Ti has the effect which generates TiNTiC like Zr and raises a high temperature strength. Since this effect i ineffective if it does not add 0.01% or more, it makes the minimum 0.01% or more. Moreover, since oxidation resistance will fall if it adds superfluously, the upper limit is limited to 2.0%. When Ti and Zr live together, Ti+Zr m be 1.5 - 3.0%. At less than 1.5%, when it is inferior to the creep property after brazing and soldering and exceeds 3% is for oxidation resistance to fall.
[0019] Nb:Nb also has the effect which generates NbCNbN and raises a high temperature strength like Zr and Ti. Sin this effect is ineffective if it does not add 0.01% or more, it makes the minimum 0.01%. Moreover, since oxidation resistance will fall if it adds superfluously, the upper limit is limited to 2.0%. When it coexists with Ti and Zr, Ti+Zr+Nb may be 1.5 - 3%. At less than 1.5%, when it is inferior to the creep property after brazing and soldering an exceeds 3%, it is for oxidation resistance to fall.
[0020] C: Since C will reduce toughness to a high temperature strength and an oxidation-resistant pan if it becomes superfluous, make it more desirable to decrease as much as possible. Therefore, it limits to 0.05% or less.
[0021] N: Since Zr, Ti, Nb, etc. which are the generation element of detailed carbide are fixed as an N ghost, the carbide of big and rough Cr and Fe deposits and N falls the intensity in an elevated temperature, it is desirable to ma it decrease as much as possible. Moreover, if N becomes superfluous, toughness will be reduced and cold rolling nat and processability will be reduced. It reacts with aluminum, and when big and rough AlN (-10micrometer) was deposited and it rolls out in an about 50-micrometer foil, it also becomes the cause of a hole aperture. Therefore, it limits to 0.03% or less.

[Translation done.]

* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EXAMPLE

[Example] this invention is concretely explained based on an example below.

[Translation done.]